

M I S S O U R I ' S
Freshwater
Mussels

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CHRIS BARNHART

Missouri's freshwater mussels live in the bottoms of rivers and streams near you. Sometimes called clams, mussels are a valuable part of our waterways, but are threatened by stream alterations and invading exotic mussels.



ussels sit quietly in the water and never utter a sound. They offer culinary and cleaning services, without lifting a finger. (They don't have any.)

They tell us if our water is clean enough for people and livestock to drink. They can live longer than most humans.

Nearly 300 species of freshwater mussels occur in North America and approximately 65 of them live in Missouri waters. The iridescent whites, brilliant purples and beautiful pinks of the nacre (nay-ker) lining the inside of their shells are as colorful as their names—washboard, pimpleback, elephantear, rabbitsfoot, spectaclecase and pink heelsplitter, to name a few.

Freshwater mussels occur throughout Missouri in a variety of habitats. Some species, like the giant floater, are widespread and likely to be found in most Missouri rivers. Other species, like the purple wartyback, may live in several regions but are found in greatest numbers in areas with particular physiogeographical characteristics.

What good are mussels, you ask?

Freshwater mussels, also known as clams or shellfish, have been an important source of food, tools, buttons and jewelry. Native Americans relied on mussel meat during the winter months when other food was scarce. They carved mussel shells and shaped them into tools.

In the early 1900s, fashionable buttons were punched from shells of freshwater mussels. The button industry originated right here in the Midwest because the Mississippi River was rich in mussels with what seemed an unlimited resource. As



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bargeloads of mussels were plucked daily from river bottoms, mussels declined rapidly and the long-lived, thick-shelled animals couldn't reproduce as quickly as they were harvested. Plastics came about in the 1940s, causing the shell button industry to fold. Mussel resources were left alone to recover.

Another commercial use for freshwater mussel shells soon came along as the cultured pearl industry expanded. The pearly white nacre of some North American mussels makes excellent starting nuclei for forming cultured pearls. Small blanks are cut from shells, formed into beads and tucked into oysters. Because the bead



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is an irritant, the oyster lays down a thick coating of secretions over it and in two to four years, a lustrous, cultured pearl is removed. Today, the cultured pearl industry is a multimillion-dollar business.

Freshwater mussels are an important food for raccoons, mink, otters and some waterfowl and fish. Muskrats may subsist on freshwater mussels during winter months, leaving piles of shells or middens on stream banks—the husks of a tasty meal.

Mussels are biological indicators of water quality because they are long-lived and relatively immobile, accumulating contaminants present in water and sediment that can be scientifically analyzed. They are nature's "vacuum cleaners," filtering and cleansing polluted waters.

Can you eat freshwater mussels?

You can eat freshwater mussels, but their meat is tough and unpalatable compared to the saltwater mussels commonly eaten. Most saltwater mussels live on rocky coastlines and attach themselves to rocks by strong filaments called byssal threads, so their meat is tender. Freshwater mussels burrow and move about on the river bottom, requiring a tough muscular foot. Plus, a freshwater mussel's foot and soft tissues are storehouses for contaminants, metals and other pollutants.

Feeding and reproduction

A freshwater mussel's body is mostly a long muscular foot that contracts and withdraws into the shell if pulled from the stream bottom. On either side of the foot is a pair of thin, specialized gills that allow the mussel to breathe and filter-feed.

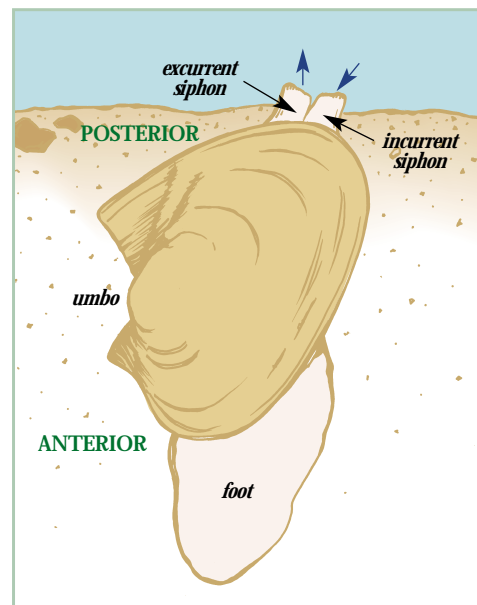
Water is drawn into the body or mantle cavity through the incurrent siphon and passes over the gills that extract oxygen and food (algae and fine particles of decaying organic matter). While food travels to the mussel's stomach, sediment and undigested wastes (called pseudofeces) quickly exit through its excurrent siphon, becoming food for other aquatic animals.

Freshwater mussels have a complex life cycle. The larval stage is parasitic on a host, typically a fish. During the breeding season, males release sperm into the water and they enter the female via her incurrent siphon to fertilize the eggs. Her modified gills are a brooding chamber for embryos that mature into microscopic larvae, called glochidia (glo-kid-ee-ah).

Mussels fool fish into carrying their larvae. Some mussels release their larvae in packages that resemble the host fish's food while other mussels have special lures to draw a fish in close. For example, the mantle flap of a female pocketbook mimics a minnow to lure in bass. The bass attempts to eat the "minnow," and it gets a mouthful of glochidia!

Glochidia clamp shut on the gills or fins of the host fish

(which usually doesn't harm the fish). If the fish is the correct host, the glochidia are attached for days or weeks, develop into juveniles and drop to the stream bottom. If they land in a suitable habitat, they grow to adults and repeat the cycle. If glochidia don't find a suitable host fish or they land in poor habitat, they will die.



Disappearing freshwater mussels

Freshwater mussels are disappearing at an alarming rate throughout North America. Nearly half of Missouri's 65 freshwater mussel species are of conservation concern. Ten of these species are listed as Endangered at either the federal or state level, and additional species are under consideration for listing.

Many Missouri watersheds have been destabilized and water quality has been degraded from poor land-use practices and urbanization. Freshwater mussels cannot tolerate a shifting, unstable stream bottom. They need a stable habitat of rocks, sand, cobble or boulders for securing themselves in an otherwise turbulent environment.

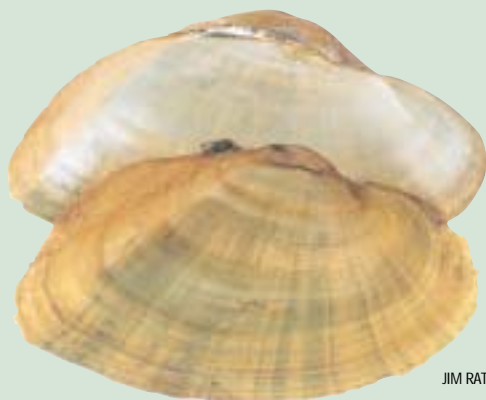
Excessive silt and gravel in streams follow excessive land disturbance. Heavy silt loads interfere with the filtering and feeding of adults and smother young mussels. Mussels can close their shells to avoid temporary slugs of pollutants coming downstream, but eventually they have to open up to breathe and feed, so long-term water quality problems in a watershed will eventually kill them.

The survival of these mussels in the state is uncertain. Habitat alteration and loss, competition from exotic species (Asian clam and zebra mussel) and over-harvesting of shells are

the primary reasons for decline. Some species that are dwindling have never been abundant here, a natural rarity that makes them even more susceptible to habitat degradation than a species that is common with a large range.

To help reverse the decline of mussels, the Missouri Department of Conservation, U.S. Fish and Wildlife Service and Southwest Missouri State University are working together to artificially propagate and restock populations of endangered mussels. The goal is to boost populations that are no longer reproducing on their own.

Habitat restoration is the key element needed to bring Missouri's mussel populations back to healthy, self-sustaining levels. Restoration of streams is a slow process, so mussel breeding in captivity may save some of our rarest mussel species.



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Elktote

Although not listed as Endangered, the elktote is one of many Missouri species with a declining population.



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Snuffbox

Four mussels are listed as Endangered in Missouri only, including the snuffbox, elephantear, ebonyshell and sheepsnose.



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Scaleshell (above) and pink mucket

The pink mucket and scaleshell mussels are listed as Endangered both in Missouri and nationwide, along with the Curtis pearlymussel, Higgins eye, fat pocketbook and winged mapleleaf (thought to be extirpated or no longer found in Missouri).

For an updated list of endangered and rare mussels, visit Missouri's Endangered Species Checklist at www.mdc.mo.gov/nathis/endangered/.

Life Cycle of a Mussel

Freshwater mussels rely on specific host fish for their larvae to develop into young mussels. For some species, finding the right host involves deception with intricate lures.

Step 1:

During the breeding season, males release sperm into the water and the females filter the sperm into their gill chambers. The female's gills incubate the fertilized eggs until they develop into tiny larvae, called glochidia.



Step 4:

If the juvenile mussels drop into good habitat, they grow into adults and the cycle is repeated. Some mussels live less than 10 years, while others live 20 to 40 or as many as 100.

Young mussels
1 to 2 years old



RICK HANSEN

Pocketbook
with fish lure



Step 2:

Glochidia must attach to the gills or fins of a specific fish species. Mussels have unusual tricks to attract their host.

Pocketbooks have a lure that looks like a small fish, while other mussels release their glochidia in packets disguised as insects or tiny fish. Host fish are fooled and try to eat the lures, taking glochidia into their mouths and gills.

They develop for several days or weeks before becoming juveniles and leaving the fish.



Step 3:

When mature, the juvenile mussels release from the host and drop onto the stream floor. Unlike other parasites, glochidia usually do not harm the host.



Encysted glochidia on fish gill.



Fish-like
packets of
larvae
(above)
and
emerging
larvae



Juvenile mussels
(2mm long)

Missouri mussel regions

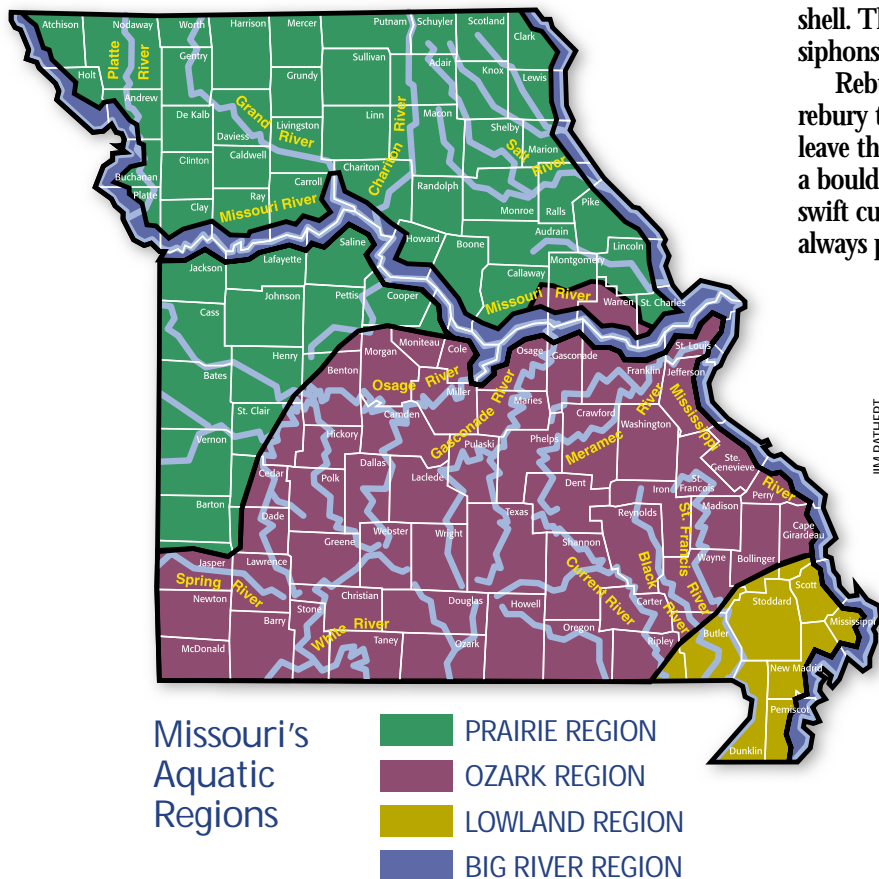
Missouri is divided into four main areas, or aquatic regions, with physiogeographical characteristics important to mussel distribution with habitats for the host fishes used in mussel reproduction.

Mussel diversity is greatest in Missouri's clear, swift-flowing rocky streams of the south-central Ozark Region. Mussels here include the round pigtoe, Wabash pigtoe, mucket, plain pocketbook, threeridge, spike, purple wartyback, ellipse, brokenray and many others living in stable stream bottoms of sand, gravel, cobble and boulders.

The Prairie Region in northern and western Missouri has fewer mussels, but numbers can be large where found. Common mussels of the firm sand, mud and clay bottom streams include the yellow sandshell, pink papershell, fragile papershell and giant floater. In ponds and lakes, watch for paper pondshell and lilliput.

The Lowland Region of southeast Missouri has changed dramatically from swampland to manmade drainage ditches in the last 100 years, but an amazing array of mussel species survive. Mussels living in the ditches with sand, clay, mud and silt include the bluefer, wartyback, three-horned wartyback, fragile papershell, mapleleaf, lilliput, pimpleback and giant floater.

The Big River Region is the Missouri and Mississippi rivers. Few mussels live in the Missouri River's swift current, shifting stream bottom and heavy silt load, although the fragile and pink papershell have adapted to the muddy waters. The once diverse mussel resource of the Mississippi River has changed in the last century due to commercial harvest and river modifications to improve navigation. Common species today include threeridge, mapleleaf, butterfly and washboard, in a mix of mud, sand and gravel.



A mussel hunt

Snorkeling and scuba diving are the most common ways to search for live freshwater mussels. Water scoping is also used when the water is cold or polluted. You can make your own water scope by cutting out the bottom of a plastic five-gallon bucket and replacing it with clear Plexiglas.

SUE BRUENDERMAN

With your face or bucket close to the stream bottom, watch for the slightest of movements. Perhaps you'll see a puff of sand or silt. If it's a freshwater mussel, the first things you'll notice are the two siphons extending from between shell halves. If you reach out and touch it, a live mussel will think you are a predator and quickly clamp shut. They are sensitive to shadows.

You can pick up a live mussel without hurting it if you treat it with care. Note the shell patterns and long foot as you pull the mussel from the stream bottom. When replacing the mussel, the part of the shell where the foot is should go down.

Mussels do not actually have a head, instead they have a long muscular foot that protrudes from their protective house-of-shell. The mussel walks through the substrate with its foot. The siphons are located at the rear (posterior) end.

Rebury the foot end into the streambed. If you accidentally rebury the siphon end, the mussel may suffocate. If unsure, leave the mussel close by in the same habitat, on its side, behind a boulder or in quiet water to rebury itself. Left unburied in swift current, a mussel can easily be swept away – take care to always put mussels back where you found them.



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Common Mussels

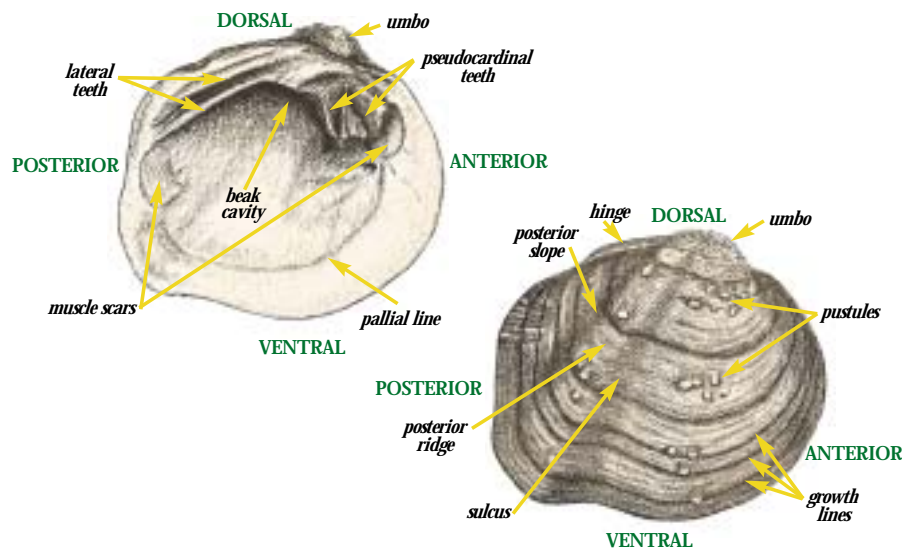
Many of Missouri's mussels are hard to identify, but with a little practice you can learn some of the ones in rivers and streams near your home. Shells of freshly eaten mussels, discarded on a streambank by a muskrat or raccoon are good for learning characteristics. Look at the shell's shape, thickness and color on the outside (epidermis) and inside. Note bumps or other outside features and the shape and size of inside teeth.

Descriptions of 29 of Missouri's colorful and fascinating mussels are included here, along with some technical terms, so you can use the diagrams to help you understand.

Additional mussels are described in references on page 16.

JIM RATHERT PHOTOS

Mussel Shell Terms



SCOTT FAIMAN ILLUSTRATION



SPECTACLECASE *Cumberlandia monodonta*

Spectaclecase live in large groups with as many as 100 mussels per square yard. The mussels can live to be 60 years or older. Missouri may have the largest number of spectaclecase mussels left in the world.

SHELL elongate and compressed with rounded ends; somewhat pinched in the middle; becomes thicker with age.

UMBO slightly elevated above hinge line.

EPIDERMIS dark brown to black, becomes brittle with age.

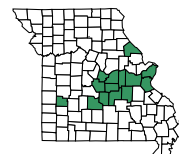
INSIDE SHELL beak cavity shallow; pseudocardinal teeth prong-like; lateral teeth poorly developed; nacre (lining) white, iridescent posteriorly.

DISTRIBUTION tributaries of the Missouri and Mississippi rivers, also Salt River.

HABITAT medium to large rivers in reduced current adjacent to swift water, among boulders or in patches of gravel, sand and cobble.

SIMILAR SPECIES Black sandshell (not shown) has a sharply pointed posterior and lacks the flaky epidermis. Adult spike can appear as a small spectaclecase, but it is neither as elongate nor pinched in shape.

ADULT SIZE 5-8"



GIANT FLOATER *Pyganodon grandis*

When a floater dies, the large mussel with thin shell will actually rise to the water surface and float as it decays. Most mussel names, by the way, have originated from the fishermen who harvested button shells in the early 1900s.

SHELL large, thin, elongate to suboval and very inflated.

UMBO swollen and elevated above hinge line.

EPIDERMIS shiny, light tan to light green or brown, becomes black to greenish-black with age; young often with faint green rays.

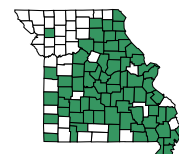
INSIDE SHELL beak cavity broad; teeth absent; nacre (lining) iridescent and variable, often silvery-white, tinged with pink or salmon.

DISTRIBUTION widespread.

HABITAT most common in sluggish sections of ponds, reservoirs, creeks and rivers in mud or silt.

SIMILAR SPECIES Flat floater is more circular and its umbo is almost flush to the hinge line. Paper pondshell has a thinner shell and a flatter umbo.

ADULT SIZE 3-8"



CLIFF WHITE



PAPER POND SHELL *Utterbackia imbecillis* (also Paper Floater)

The paper pondshell is an oddball – a single mussel can be both male and female. The larvae or glochidia have hooks and attach to the fins of a host fish. Young mussels can be a beautiful bright green, with thin glossy shells.

SHELL very thin, elongate; oblong and inflated in adults.

UMBO not raised above the very flat hinge line.

EPIDERMIS shiny, yellow to green with faint yellow to green rays.

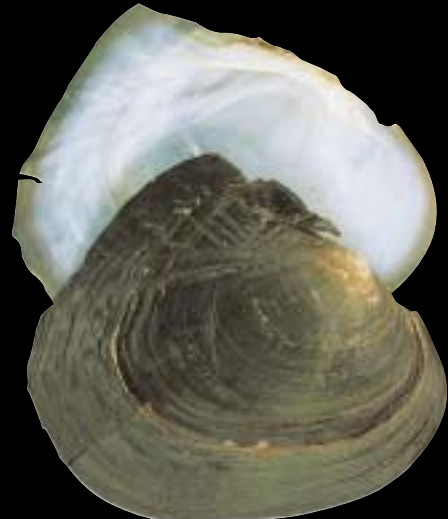
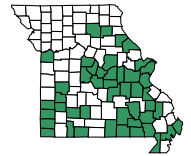
INSIDE SHELL beak cavity shallow to absent; teeth absent; nacre (lining) iridescent white to bluish-white.

DISTRIBUTION sporadic; sometimes locally abundant.

HABITAT quiet water in ponds, reservoirs, sloughs and streams in silt or a mix of silt and fine sand.

SIMILAR SPECIES Small giant floaters are distinguished by umbo distinctly raised above the hinge line.

ADULT SIZE 1-4"



WHITE HEELSPLITTER *Lasmigona complanata*

The shell is large and impressive in overall size. Although fairly flat, it can be more than 8 inches long. A large wing on the heelsplitter can be painful if you step on it.

SHELL large, very compressed and rounded with a large wing above the hinge line.

UMBO flattened, small and not raised above hinge line.

EPIDERMIS green or greenish-brown, often with faint rays, becomes dark brown to black with age.

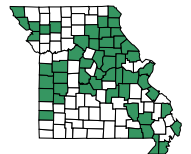
INSIDE SHELL beak cavity shallow; pseudocardinal teeth large; lateral teeth blade-like and poorly developed; nacre (lining) bluish-white to white, iridescent posteriorly.

DISTRIBUTION widespread, except for south-central Ozarks.

HABITAT slow current in firm mud and sand or fine gravel; also in lakes and ponds.

SIMILAR SPECIES Pink heelsplitter is more inflated with a pinkish-purple nacre. Pink papershell is generally smaller with a thinner shell and purple nacre.

ADULT SIZE 4-8"



PISTOLGRIP *Tritogonia verrucosa* (also Buckhorn)

Shaped like a checkered gunstock, pistolgrips are easy to identify.

SHELL heavy, compressed and elongate; covered with pustules (knobs); pronounced, knobby posterior ridge with flutings and folds extending to margin.

UMBO slightly elevated above hinge line, turned forward.

EPIDERMIS light green to brown in juveniles and brown or black in adults.

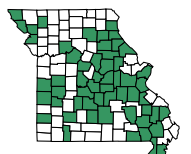
INSIDE SHELL beak cavity moderately deep; pseudocardinal teeth large and serrate; lateral teeth long, straight and heavy; nacre (lining) usually white, iridescent posteriorly.

DISTRIBUTION widespread, sometimes locally common.

HABITAT medium to large rivers with moderate current in stable gravel and sand or mud.

SIMILAR SPECIES None due to the distinct shape of its knobby shell.

ADULT SIZE 4-7"





MONKEYFACE *Quadrula metanevra*

Finding the monkey's face in the shell is left up to the imagination.

SHELL thick, rounded or squared and inflated, with very prominent posterior ridge and lobed posterior margin; pustules (bumps) extend from umbo to posterior ventral margin, increasing in size.

UMBO narrow, slightly raised above hinge line.

EPIDERMIS yellowish-green, becomes brown with age; may have randomly scattered dark-green chevron marks.

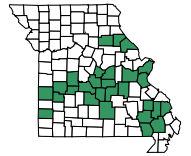
INSIDE SHELL beak cavity deep; pseudocardinal teeth large, grooved and triangular; lateral teeth short, streaked and straight; nacre (lining) white, iridescent posteriorly.

DISTRIBUTION rivers flowing off the Salem and Springfield plateaus (except for south-flowing streams in the central lower Ozarks); Mississippi and Salt rivers.

HABITAT medium to large rivers in relatively swift current in a stable clean-swept mix of coarse sand and gravel.

SIMILAR SPECIES None. The prominent posterior ridge, pustules and knobs make this species easy to identify.

ADULT SIZE 2-4"



WARTYBACK *Quadrula nodulata*

The bumps on the shell of the wartyback may help to anchor it in the river bottom.

SHELL thick anteriorly to thin posteriorly; rounded to squared-off moderately inflated shell with two poorly defined rows of elongated knobs diverging from the umbo to the ventral margin.

UMBO rounded and raised high above the hinge line.

EPIDERMIS generally yellowish to light brown, becomes darker with age.

INSIDE SHELL beak cavity deep; pseudocardinal teeth large, grooved and roughened; lateral teeth moderately long, grooved and slightly curved; nacre (lining) white, iridescent posteriorly.

DISTRIBUTION most often found in rivers of the Lowland Region, northeast Missouri and Mississippi River; may be locally abundant.

HABITAT most common in large streams or rivers in firm sand and mud.

SIMILAR SPECIES Pimplebacks are similar, but have randomly distributed small knobs and may have a green ray from umbo to halfway down shell. Monkeyface has a distinct groove.

ADULT SIZE 2-3"



PIMPLEBACK *Quadrula pustulosa*

The pimpleback is usually bumpy, but some individuals are perfectly smooth.

SHELL thick, rounded to squared, moderately inflated and covered with few to many pustules (bumps) in no discernable pattern; smooth anterior third.

UMBO elevated above hinge line and turned forward.

EPIDERMIS yellowish-green to light brown in juveniles, becomes chestnut to brown with age; may have a broad green ray on the umbo.

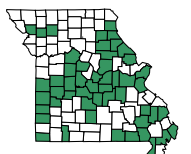
INSIDE SHELL beak cavity deep; pseudocardinal teeth well-developed and serrate; lateral teeth moderately short, heavy, serrate and straight to slightly curved; nacre (lining) white, iridescent posteriorly.

DISTRIBUTION widespread.

HABITAT small to large rivers in coarse gravel and sand or mud.

SIMILAR SPECIES Wartyback has knobs arranged in two weakly defined rows and the green umbo ray is not present. Purple wartyback is more compressed with a purple nacre.

ADULT SIZE 2-3"





MAPLELEAF *Quadrula quadrula*

The mapleleaf spawns in the summer, using catfish as a host.

SHELL thick, squared to rounded and slightly inflated with two rows of pustules (bumps) radiating from the umbo to the shell margin and separated by a sulcus (smooth depression); anterior portion usually smooth.

UMBO small, slightly raised above hinge line.

EPIDERMIS yellowish-green with faint rays in juveniles; darkens with age to medium to dark greenish-brown or brown.

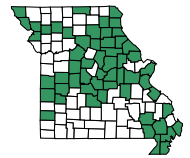
INSIDE SHELL beak cavity deep; pseudocardinal teeth serrate and well developed; lateral teeth long and straight; nacre (lining) white, iridescent posteriorly.

DISTRIBUTION widespread except for south-central Ozarks.

HABITAT quiet sections of medium to large rivers and reservoirs in sand, mud and fine gravel.

SIMILAR SPECIES Wartyback and pimpleback do not have a depression and are more rounded. Purple wartyback is generally more compressed and has purple nacre. Monkeyface has a row of knobs instead of a depression.

ADULT SIZE 3-5"



THREERIDGE *Amblema plicata*

Sometimes called blue-point, this mussel species is widely distributed in Missouri rivers and is occasionally found along reservoir margins.

SHELL thick, heavy, rounded to squared, occasionally inflated and covered with three or more posterior folds or ridges.

UMBO raised above hinge line.

EPIDERMIS yellowish-green to light brown in juveniles, becomes dark green, brown or black with age.

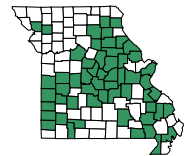
INSIDE SHELL beak cavity medium to deep; pseudocardinal teeth large and thick; lateral teeth serrate, straight to slightly curved; nacre (lining) white and frequently stained.

DISTRIBUTION one of the most widespread mussels; absent from north-central Missouri.

HABITAT small streams to large rivers in mud, sand and gravel.

SIMILAR SPECIES Washboard is larger with more complex folding and has bumps on the anterior third of shell.

ADULT SIZE 3-7"



WABASH PIGTOE *Fusconaia flava*

A widespread mussel that releases its larvae in tiny red packages to attract fish hosts.

SHELL variable, usually thick, square to triangular, somewhat compressed (creeks and small rivers) to inflated (large rivers); a broad sulcus (smooth depression) extends from umbo to ventral margin.

UMBO moderately to highly elevated above hinge line.

EPIDERMIS yellowish-brown with faint green rays in juveniles, becomes dark brown with age.

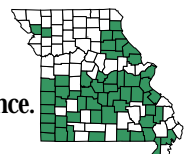
INSIDE SHELL beak cavity deep; pseudocardinal teeth rough and well-developed; lateral teeth serrate and straight to slightly curved; nacre (lining) white, often tinged with salmon.

DISTRIBUTION widespread; most common in north-flowing streams south of the Missouri River, also Salt River.

HABITAT medium to large rivers in moderate current with a stable mix of coarse sand and gravel.

SIMILAR SPECIES Wabash pigtoes are easily confused with round pigtoes, which generally lack a sulcus and have a rounded appearance.

ADULT SIZE 2-4"





PURPLE WARTBACK *Cyclonaias tuberculata* (also Purple Pimpleback)

A coppery-purple shell was not in fashion with the button industry – only white was used. SHELL thick, heavy, nearly round, compressed (small rivers) to inflated (large rivers) and covered with many bumps; anterior end rounded, posterior end squared off. UMBO slightly raised above hinge line.

EPIDERMIS yellowish-brown to greenish-brown, becomes darker with age; greenish rays may be present in juveniles.

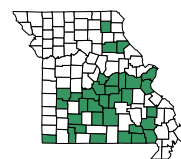
INSIDE SHELL beak cavity deep and wide; massive pseudocardinal teeth, widely spaced and deeply grooved; lateral teeth short and straight or slightly curved; nacre (lining) deep coppery-purple.

DISTRIBUTION mainly in the Ozarks, but also Salt and Fabius rivers.

HABITAT medium to large rivers with moderate current in sand, gravel and cobble.

SIMILAR SPECIES Pimpleback and wartback are less massive and less compressed, have white nacre and smaller pseudocardinal teeth. Mapleleaf has a definite sulcus, white nacre and smaller pseudocardinal teeth.

ADULT SIZE 2-4"



ROUND PIGTOE *Pleurobema sintoxia*

Round pigtoes are more rounded than Wabash pigtoes. Rare individuals have a bright pink nacre.

SHELL relatively thick, heavy, compressed and rounded (small streams) or inflated and mostly triangular (big rivers).

UMBO low, slightly raised above hinge line and tilted forward.

EPIDERMIS greenish- to reddish-brown or light brown in juveniles and chestnut or dark brown in adults; usually without rays.

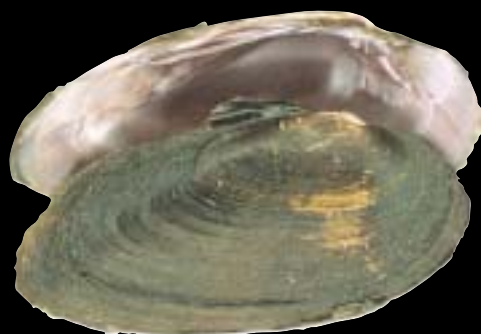
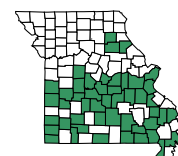
INSIDE SHELL beak cavity shallow (medium streams) to moderately deep (large rivers); pseudocardinal and lateral teeth well developed, with the lateral primarily straight; nacre (lining) white, occasionally pinkish.

DISTRIBUTION widespread in the Ozarks, but also Salt and lowland rivers.

HABITAT medium-sized rivers in moderate current with stable gravel, sand and cobble.

SIMILAR SPECIES See comparisons for Wabash pigtoe, page 9.

ADULT SIZE 2-4"



SPIKE *Elliptio dilatata* (also Ladyfinger)

Nacre color varies from purple to pink to white. In smaller rivers, the shell is much thinner.

SHELL thick, slightly inflated to compressed and elongate; generally twice as long as width; ventral margin either straight or slightly curved in juveniles.

UMBO low and rarely raised above hinge line.

EPIDERMIS greenish-brown with faint green rays, dark brown to black with age.

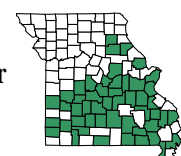
INSIDE SHELL beak cavity shallow to absent; pseudocardinal teeth triangular and streaked; lateral teeth short and straight; nacre (lining) purple, occasionally pink or white.

DISTRIBUTION common and locally abundant south of the Missouri River; also in northeast Missouri.

HABITAT small to large streams with moderate to strong current in stable sand and gravel.

SIMILAR SPECIES Young or small spectaclecase could be confused with the spike, but they appear pinched. The black sandshell (not shown) is longer and thicker with a more prominent posterior ridge and a shiny exterior that is usually darker.

ADULT SIZE 3-5"





THREEHORN WARTYBACK *Obliquaria reflexa*

As with many Missouri mussels, the fish host of this widespread mussel is unknown.

SHELL small, moderately thick and rounded with 3 to 4 large knobs or horns on each valve (shell half), alternating with those on the opposite valve; distinct depressions above each knob.

UMBO raised above hinge line.

EPIDERMIS light tan to green, darker with age; often with fine green rays.

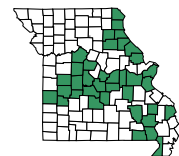
INSIDE SHELL beak cavity shallow to moderately deep; pseudocardinal teeth heavy, serrate and well developed; lateral teeth grooved, relatively long and straight to slightly curved; nacre (lining) white.

DISTRIBUTION north-flowing streams south of the Missouri River; also southeastern Ozarks and Salt River.

HABITAT larger streams and rivers with moderate current in gravel, sand and mud; also in reservoirs.

SIMILAR SPECIES Pimpleback and wartyback are similar, but neither has the fine green rays of the threehorn wartyback, nor such large, distinct knobs with associated depressions.

ADULT SIZE 2-3"



MUCKET *Actinonaias ligamentina*

One of the most widespread and numerous mussels in southern Missouri.

SHELL thick, heavy, oblong and moderately inflated.

UMBO low and slightly above hinge line.

EPIDERMIS yellowish-brown, becomes darker with age; green rays may be present.

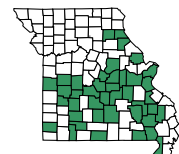
INSIDE SHELL beak cavity shallow; large pseudocardinal teeth, serrate and slightly elevated; lateral teeth blade-like, straight to slightly curved, moderately short and serrate; nacre (lining) white, rarely pink-tinged.

DISTRIBUTION widespread and abundant in southern Missouri; also Salt River.

HABITAT medium to large rivers in relatively swift water with a stable mix of gravel, sand and cobble.

SIMILAR SPECIES The plain pocketbook's shell is more inflated, less stout, thinner, more square (females) or rounded (males) and has a higher umbo.

ADULT SIZE 3-7"



CLIFF WHITE



BUTTERFLY *Ellipsaria lineolata*

The butterfly is one of the most beautiful of Missouri's mussels.

SHELL solid, thick, noticeably flattened and triangular with a prominent and sharply angled posterior ridge.

UMBO flattened on the sides, directed forward and slightly raised above hinge line.

EPIDERMIS yellowish-brown with interrupted but distinct brown rays that appear as spots, bars, wavy patterns or V-shapes (chevrons).

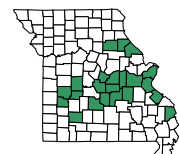
INSIDE SHELL beak cavity shallow; pseudocardinal teeth large, grooved and triangular; lateral teeth serrate, short and straight; nacre (lining) white.

DISTRIBUTION most common in north-flowing tributaries of the Missouri River and in several Mississippi River tributaries.

HABITAT large rivers with strong current in coarse gravel and sand.

SIMILAR SPECIES Deertoe has a similar color pattern, but the shell is much more inflated and has a deeper beak cavity.

ADULT SIZE 3-5"





DEERTOES *Truncilla truncata*

A common mussel in some areas, deertoe have decorative green markings.

SHELL solid, thick, inflated, mostly triangular; prominent posterior ridge drawn to a rounded point at the posterior end.

UMBO wide and raised above hinge line.

EPIDERMIS yellowish-brown to brown; numerous green rays vary in width with spots, zigzags or most often V-shapes (chevrons); sometimes without rays.

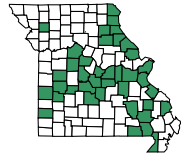
INSIDE SHELL beak cavity moderately deep; pseudocardinal teeth triangular, grooved and well developed; lateral teeth short, thin, grooved and straight to slightly curved; nacre (lining) white, rarely pinkish-salmon.

DISTRIBUTION sporadic, may be locally common where found.

HABITAT medium to large rivers with moderate to swift current in gravel mixed with sand and mud.

SIMILAR SPECIES Butterfly has a flattened appearance and less developed rays. Fawnsfoot (not shown) is easily confused with the deertoe, but is longer with a less prominent dorsal ridge and more distinct zigzag marks covering the shell.

ADULT SIZE up to 3"



FRAGILE PAPERSHELL *Leptodea fragilis*

A widespread mussel that relies on freshwater drum as host fish for the developing young.

SHELL thin, fragile or brittle, oblong to oval; dorsal wing on young, often eroding with age.

UMBO flattened and barely above hinge line.

EPIDERMIS light yellowish-tan to dirty yellow-brown in adults; faint, narrow green rays may cover shell.

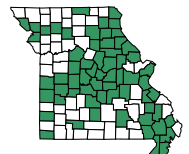
INSIDE SHELL beak cavity shallow; pseudocardinal teeth small, thin and reduced; lateral teeth smooth, moderate length, very thin, blade-like and high; nacre (lining) bluish-white, iridescent throughout and may be pinkish dorsally.

DISTRIBUTION widespread and locally common where found; absent from south-flowing streams in south-central Ozarks.

HABITAT streams of all sizes in reduced current in firm sand and mud.

SIMILAR SPECIES Pink papershells have darker epidermis and purple to purplish-bronze nacre.

ADULT SIZE 3-6"



PINK HEELSPLITTER *Potamilus alatus*

A large dorsal wing and purple lining make identification easy.

SHELL large, inflated, laterally compressed, elongate to rectangular with a large dorsal wing; anterior end sharply rounded; posterior end broadly rounded.

UMBO flattened and only slightly raised above hinge line.

EPIDERMIS brown to greenish-brown, becomes darker with age; juveniles often with faint green rays, later fading.

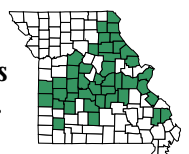
INSIDE SHELL beak cavity shallow; pseudocardinal teeth relatively thin, small and rough; lateral teeth high and moderately long, blade-like and straight to slightly curved; nacre (lining) purple to pinkish-purple.

DISTRIBUTION widespread; most common in Osage, Meramec and Salt river basins.

HABITAT margins of medium to large streams with mixed sand and mud or sand, gravel and cobble.

SIMILAR SPECIES White heelsplitter is compressed and rounded with a white nacre. Pink papershell has a thinner shell, is less inflated, is not rounded posteriorly and has reduced teeth. Bluefer is more inflated with a deeper beak cavity and a squared posterior end.

ADULT SIZE 3-8"





PINK PAPERSHELL *Potamilus ohienensis*

The dorsal wing connects the shell halves and covers the hinge.

SHELL thin, compressed, oval to rectangular with a large dorsal wing.

UMBO not raised above hinge line.

EPIDERMIS shiny, light tan to olive-brown, becomes darker brown with age; light tan juveniles may have a greenish cast; without rays.

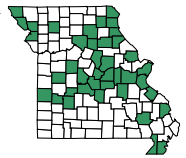
INSIDE SHELL beak cavity shallow; pseudocardinal teeth thin, small and erect; lateral teeth thin, blade-like and slightly curved; nacre (lining) light purple.

DISTRIBUTION relatively widespread; most common in Gasconade, Osage, Grand, Chariton, Lamine, North Fabius and Salt rivers; uncommon where found.

HABITAT shallow areas of medium to large rivers with slow current in silt, mud or sand.

SIMILAR SPECIES Pink heelsplitter has a darker, thicker shell with a deep purple nacre and larger pseudocardinal teeth. Fragile papershell is light yellow with a darker area near the umbo and whitish to whitish-blue nacre, possibly with a pink tinge.

ADULT SIZE 3-6"



BLUEFER *Potamilus purpuratus* (also Purpleshell)

The bluefer, pink heelsplitter and fragile and pink papershells use freshwater drum as a host.

SHELL stout, inflated, oval to rectangular and thick with a posterior wing; round anterior end and broadly rounded posterior ridge; posterior end bluntly squared (females) to sharply rounded (males).

UMBO broad and raised above hinge line.

EPIDERMIS smooth and glossy, dark brown, becomes black with age; dark green rays on young, later fading.

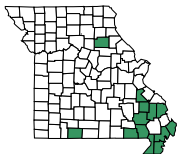
INSIDE SHELL beak cavity broad and deep; pseudocardinal teeth relatively small, roughened and pointed; lateral teeth prominent, blade-like and slightly curved; nacre (lining) pinkish-purple to deep purple.

DISTRIBUTION restricted to the Lowland Region in flood control ditches and White, Black, St. Francis and Mississippi river tributaries.

HABITAT medium to large rivers with reduced current in a stable mix of mud and silt or mud and gravel.

SIMILAR SPECIES Pink heelsplitter is lighter in color and less inflated or stout and its nacre is lighter in color.

ADULT SIZE 3-8"



LILLIPUT *Toxolasma parvus*

The smallest of Missouri's freshwater mussels.

SHELL small, stout, thick, elliptical and inflated.

UMBO moderately broad and low.

EPIDERMIS light brown to greenish-brown, becomes dark brown to black with age.

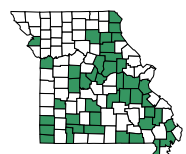
INSIDE SHELL beak cavity shallow to moderately deep; pseudocardinal teeth thin, high, triangular and roughened; lateral teeth also thin but well developed, long, high and blade-like; nacre (lining) bluish-white, sometimes with salmon tinge, iridescent posteriorly.

DISTRIBUTION sporadic, but more common than the other two lilliput species.

HABITAT large rivers with slow to no current in silt, silt and sand or fine gravel; also in ponds, lakes and overflow waters.

SIMILAR SPECIES Purple lilliputs (not shown) have larger, more rounded shells with distinctive purple nacre and are found in the southern Ozarks. Texas lilliputs (not shown), newly known in Missouri, have a satiny sheen to their shells.

ADULT SIZE 1-2"





PONDMUSSEL *Ligumia subrostrata*

One of the few Missouri mussels successful in ponds and lakes.

SHELL stout, moderately inflated and elongate; posterior end pointed (males) and broader and squared off (females).

UMBO slightly raised above hinge line.

EPIDERMIS dull, greenish-yellow in juveniles, becomes dark brown to black in adults, often with dark green rays that may become less distinct with age.

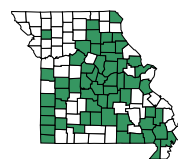
INSIDE SHELL beak cavity shallow; pseudocardinal teeth thin, triangular and nearly parallel to one another; lateral teeth long, thin and straight; nacre (lining) white, iridescent posteriorly.

DISTRIBUTION widespread, may be locally abundant.

HABITAT quiet waters of creeks and rivers in silt, mud or sand.

SIMILAR SPECIES Black sandshell (not shown) is glossy, darker, longer, larger and heavier with pointed posterior end. Spike has a thicker, heavier shell, not as inflated with well-developed teeth. Little spectaclecase (not shown) is thicker, more oval and inflated.

ADULT SIZE 2-4"



ELLIPSE & BLEEDINGTOOTH *Venustaconcha ellipsiformis* & *V. pleasii*

Small mussels that use darters as hosts.

SHELL small, relatively thick, elliptical to elongate, compressed to moderately inflated with a bluntly pointed (ellipse shown) to acutely rounded (bleedingtooth) posterior end and a thicker anterior end (ellipse).

UMBO low and slightly raised above hinge line.

EPIDERMIS yellowish-brown to brown in adults with many fine dark green rays.

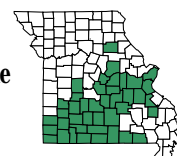
INSIDE SHELL beak cavity shallow; pseudocardinal teeth triangular, heavy and roughened; lateral teeth short, thick and straight to slightly curved; teeth sometimes rusty-red; nacre (lining) bluish-white and often tinged with rusty salmon.

DISTRIBUTION north-flowing (ellipse) and south-flowing (bleedingtooth) streams.

HABITAT small to relatively large rivers in noticeable current with firm sand or mixed sand and gravel.

SIMILAR SPECIES Juvenile mucklets are shorter, stouter and uniformly thick and lack the fine rays. Brokenray is shorter, more rounded and thinner and females often have an indentation in the posterior margin.

ADULT SIZE 1-3"



YELLOW SANDSHELL *Lampsilis teres*

The uniform shell thickness and hard, white nacre made it a favorite for button manufacturing.

SHELL thick, inflated, elongate with a pointed posterior end.

UMBO low and broadly rounded.

EPIDERMIS shiny; younger mussels yellowish-green with fine green rays; adults straw-colored with faint or no rays, becomes darker with age.

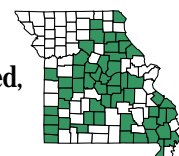
INSIDE SHELL beak cavity moderately deep; pseudocardinal teeth thin, elongate, serrate and well-developed; lateral teeth long and straight to slightly curved; nacre (lining) white.

DISTRIBUTION widespread, absent from south-flowing streams in south-central Missouri.

HABITAT small to large rivers in slow to moderate current in sand, sandy mud or fine gravel; also ponds, sloughs and reservoirs.

SIMILAR SPECIES Black sandshell (not shown) has a very dark epidermis. Fatmucket's shell is not as elongate and more inflated, typically with prominent rays.

ADULT SIZE 3-6"





PLAIN POCKETBOOK *Lampsilis cardium* (also Pocketbook)

In this mussel and other *Lampsilis*, mantle flaps in the shape of a fish are used to lure a host.

SHELL large, moderately thick, inflated, rounded to oval shell with a blunt posterior end (males) or squared-off posterior end (females).

UMBO broad, raised above hinge line.

EPIDERMIS smooth, yellow to tan to yellowish-green with dark green rays.

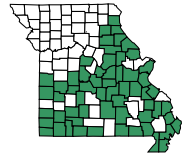
INSIDE SHELL beak cavity deep; pseudocardinal teeth large, heavy and serrate; lateral teeth high, blade-like and short; nacre (lining) white, occasionally pink or salmon.

DISTRIBUTION widespread and common except for northwest and far north Missouri.

HABITAT creeks to large rivers with moderate to swift current in gravel, sand and cobble.

SIMILAR SPECIES Fatmucket's shell is not as inflated and has a lower umbo. The mucket's shell is more oval and compressed.

ADULT SIZE 4-7"



BROKENRAY *Lampsilis reeveiana*

Includes three subspecies, Ozark (Broken Rays), Northern (Britt's) and Arkansas (Reeves).

SHELL relatively thin, elliptical to oval (females) with rounded anterior margin; sharply rounded to angular posterior margin (males); more broadly rounded posteriorly with slight indentation on posterior margin (females).

UMBO low, slightly raised above hinge line.

EPIDERMIS smooth, shiny yellowish-brown; green rays numerous posteriorly.

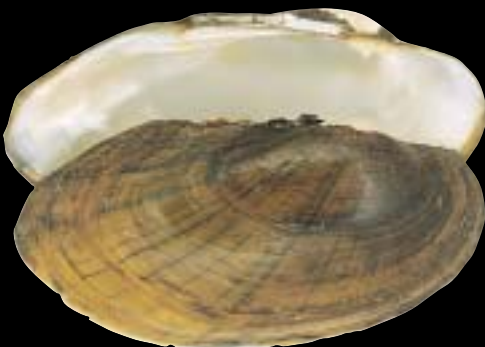
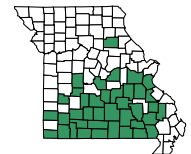
INSIDE SHELL beak cavity shallow; pseudocardinal teeth small, erect, roughened and often divergent; lateral teeth short, straight to slightly curved, blade-like; nacre (lining) iridescent white to bluish-white to salmon.

DISTRIBUTION south-flowing streams off the Salem and Springfield plateaus (Ozark and Arkansas), north-flowing streams off these plateaus (northern). Arkansas brokenray very rare.

HABITAT cool, clear headwaters to moderate-sized rivers with noticeable current in stable sand and gravel.

SIMILAR SPECIES Ellipse is more elongate and thicker with well-developed and stout teeth.

ADULT SIZE 2-4"



FATMUCKET *Lampsilis siliquoidea*

The fatmucket was another favorite button shell in the early 1900s.

SHELL moderately thick, elongate, anterior end rounded with a blunt posterior end (males) or inflated and squared-off posterior end (females).

UMBO slightly raised above hinge line.

EPIDERMIS smooth, shiny yellow to brownish-yellow, becomes dark chestnut in some older adults; usually distinct green rays.

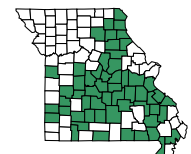
INSIDE SHELL beak cavity moderately deep; pseudocardinal teeth thin to triangular and roughened; lateral teeth blade-like, moderately long and straight; nacre (lining) bluish-white, iridescent posteriorly.

DISTRIBUTION nearly statewide except for north-central and northwest Missouri.

HABITAT small to large streams with quiet waters in sand and mud.

SIMILAR SPECIES Plain pocketbook is more inflated and has a higher umbo. The mucket's shell is more oval and compressed.

ADULT SIZE 3-6"



Missouri mussel invaders

Two exotic freshwater mussels, the Asian clam (*Corbicula fluminea*) and the zebra mussel (*Dreissena polymorpha*), have found their way to Missouri. The Asian clam was introduced into the western U.S. from Asia in the 1930s and quickly spread eastward. Since 1968 it has spread rapidly throughout Missouri and is most abundant in streams south of the Missouri River. In the mid-1980s, zebra mussels hitched a ride in the ballast waters of freighter ships traveling from Asia to the Great Lakes. They have rapidly moved into the Mississippi River basin and westward to Oklahoma.

Asian clam and zebra mussel larvae have an advantage here because they don't require a fish host to reach a juvenile stage

Zebra mussels attached to a native mussel



CHRIS BARNHART

ZEBRA MUSSEL

A female can produce more than a million larvae at one time, several times per year.

SHELL slightly elongate, triangular and D-shaped.

EPIDERMIS very distinctive with alternating bands of light and dark colors.

THREAT attach to any solid surface in dense clusters, including industrial pipes and native mussels; if enough attach to a native mussel, it cannot open its shell and soon dies.

ADULT SIZE 1"

and can reproduce at a much faster rate than native mussels. Zebra mussels attach to any solid surface, including industrial pipes, native mussels and snails and other zebra mussels. They form dense clumps that suffocate and kill native mussels by restricting feeding, breathing and other life functions.

You can help stop the spread of these mussels by not moving bait or boat well water from one stream to another; dump and drain on the ground before leaving. Check all surfaces of your boat and trailer for zebra mussels and destroy them, along with vegetation caught on the boat or trailer. Wash with hot (104°F) water at a carwash and allow all surfaces to dry in the sun for at least five days before boating again.



JIM RATHER

ASIAN CLAM

Shells are very common statewide in rivers, ponds and reservoirs and are often found on banks and gravel bars.

SHELL thick, rounded to somewhat triangular and inflated.

EPIDERMIS greenish-yellow to black with heavy, concentric ridges, originating from the umbo.

INSIDE SHELL deep interior beak cavity; prominent teeth; white to dark purple nacre (lining).

THREAT believed to compete with native mussels for food and habitat.

ADULT SIZE 1.5"

Mussel builders

Freshwater mussels need clean water and stable rivers and streams. The Missouri Stream Team program is a network of citizens concerned about Missouri streams who get involved in river conservation. Joining a Stream Team is a good way to help



our streams, from water quality and litter control to creating wildlife habitat. For more information: Stream Team Coordinator, Missouri Department of Conservation, P.O. Box 180, Jefferson City, MO 65102-0180, call 1-800-781-1989 or visit www.mostreamteam.org.

Equal opportunity to participate in and benefit from programs of the Missouri Department of Conservation is available to all individuals without regard to their race, color, national origin, sex, age or disability. Complaints of discrimination should be sent to the Department of Conservation, P.O. Box 180, Jefferson City, MO 65102, OR U.S. Fish & Wildlife Service, 18th and "C" Streets NW, Washington D.C. 20240, Missouri Relay Center-1-800-735-2966 (TDD).

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Resources

Field Guide to Freshwater Mussels of the Midwest.

K. S. Cummings and C.A. Mayer. Illinois Natural History Survey Manual 5, 1992. Color illustrations of midwestern mussel species. (See web site below.)

Missouri Naiades: A Guide to the Mussels of Missouri.

Ronald D. Oesch. Missouri Department of Conservation, 1995. A guide with drawings and detailed descriptions of all Missouri mussels. Note that many of the scientific names have changed since it was updated, but common names used in the book are noted here. (Available from Nature Shop, Missouri Department of Conservation, P.O. Box 180, Jefferson City, MO 65102-0180 for \$6, plus \$2 for shipping and handling. Missouri residents add 6.225 percent sales tax.)

courses.smsu.edu/mcb095f/gallery/

The Unio Gallery at Southwest Missouri State University contains some of Dr. Chris Barnhart's fascinating photos and videos of the life cycle of mussels.

www.inhs.uiuc.edu/cbd/musselmanual/cover.html

Web site for the Field Guide to Freshwater Mussels of the Midwest, by Kevin S. Cummings and Christine A. Mayer of the Illinois Natural History Survey. The book is online.